

of the depression to be northwest of Marquette, Michigan. A slight increase of pressure was apparent on the morning of the 28th, and the area of low was not clearly defined, but the centre had moved eastward. In the afternoon the centre of depression was near La Crosse, Wisconsin, indicating a retrograde movement, but the midnight map showed the centre of disturbance again north of Mackinaw City, Michigan, after which it moved eastward, attended by light rains and thunder-storms in east Michigan and Canada West, passing up the Saint Lawrence Valley and into the Gulf on the morning of the 30th.

Severe storms occurred in the middle Atlantic states and New England during the passage of this area over the Saint Lawrence Valley, as will be seen from the following reports:

Burlington, Vermont: on the 29th a severe thunder-storm and high wind occurred at Georgia, Milton, and other places north of this place. Hail did considerable damage to corn, oats, and other crops, besides breaking many windows. In some places the wind blew with almost hurricane force and numerous buildings were unroofed.

Albany, New York: on the 29th, between 9 p. m. and midnight, a very destructive thunder-storm passed over this city and the adjacent country. Between 10 and 11 p. m. the electrical part of the storm was most intense; flashes of lightning were almost incessant, and numerous buildings were struck and burned; the loss from barns which were burned during this storm will aggregate \$15,000. The storm was accompanied by high wind which did considerable damage.

Sandy Hook, New Jersey: after a cloudy and extremely sultry day a thunder-storm was observed approaching the station from the northwest at 6:15 p. m. of the 30th. At 6:45 p. m. the storm struck this point with great force, and very heavy rain fell. The storm was accompanied by heavy hail, some of the stones being the size of walnuts, also by a heavy northwest squall, the wind blowing for about an hour at the rate of seventy-two miles per hour. After the storm had passed, thirty wrecks were reported from different points along the coast, and several persons drowned.

Hartford, Connecticut: a severe thunder-storm and southeast gale occurred during the night of the 29-30th. At Wethersfield, four miles south of this city, considerable damage was done by the high wind and hail which accompanied the storm at that place. The hail destroyed many acres of tobacco, entailing a loss of nearly \$15,000. The storm was severe along Long Island Sound, where lightning struck many buildings and killed live stock.

Taunton, Massachusetts: on the 30th, between 2.50 and 3.45 a. m., a very severe thunder-storm occurred here. The thunder and lightning were continuous, there being no distinguishable interval between the flashes. Five buildings in this town, and many in adjoining towns, were struck by lightning.

Coney Island, New York: the storm that passed over Coney Island on the night of the 30th-31st is thought to have been the most violent of any that has occurred at this place during the summer for many years. The gale was accompanied by rain, hail, and heavy thunder and lightning. Numerous buildings were unroofed by the wind and windows broken by hail.

Philadelphia, Pennsylvania: at 3 a. m. on the 31st a gale and heavy thunder occurred in this city and over the surrounding country. Trees were uprooted by the gale, and signs and awnings blown down. The lightning was severe and several buildings were struck. Reports from Atlantic City and numerous other points along the New Jersey coast state that the gale was severe and the rainfall very heavy.

NORTH ATLANTIC STORMS DURING JULY, 1886.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Philadelphia, and Boston; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data received at this office up to August 20, 1886.

Of the twelve depressions traced during the month, seven, numbers 4, 5, 7, 8, 10, 11, 12, are continuations of areas of low pressure traced on the North American continent; number 1 is a continuation of land depression number x charted for June, 1886; numbers 2, 6, and 9 developed over mid-ocean; and number 3 first appeared over Newfoundland. Three depressions, numbers 3, 5, and 7, are traced across the ocean from coast to coast.

The following presents the characteristics of the depressions traced for the present month, as compared with those traced over the north Atlantic for July, 1885:

In July, 1885, six depressions appeared over the ocean, two of which were continuations of areas of low pressure which first appeared over the North American continent, but neither of these were traced to the European coast. The depressions were apparently of slight energy and were not accompanied by gales of marked violence. The general direction of movement of the tracks was east to northeast.

In July, 1886, the storms, as a rule, possessed considerable strength, and, while the depressions did not exhibit unusually low pressures, the barometric gradients were, in cases, sufficiently steep to cause disturbances of pronounced energy. The general direction of movement of the paths was, as in July, 1885, east to northeast, although in instances irregular courses were followed. The rate of progression of the depressions was, as a rule, unusually rapid.

The month opened with generally unsettled weather over the ocean; the barometer was high over the Azores, and areas of low pressure were located over Newfoundland and in about N. 42°, W. 43°. Following the eastward passage of these depressions the weather was generally fair over the ocean west of the fortieth meridian until the 7th, when the passage of an area of low pressure northeastward from Newfoundland caused gales and generally rough weather in the trans-Atlantic track during the next three days. On the 10th the pressure was high over the entire ocean south of the fiftieth parallel, except off the northern coast of the United States, where it continued low during the next two days. From the 10th to the 15th low pressure and generally stormy weather prevailed north of the fiftieth parallel, while over other portions of the ocean the weather was unsettled. From the 15th to 20th the region of greatest disturbance was to the eastward of the thirtieth meridian, while during the next five days storm-conditions existed over the entire ocean; fairer weather prevailing over the western portion during the 24th and 25th. On the 26th fresh gales and rain were encountered to the westward of the British Isles; during the balance of the month rain was frequent over the entire ocean, and during the 30th and 31st fresh gales prevailed over mid-ocean from N. 47° to 55°.

The following are brief descriptions of the depressions traced:

1.—This storm was a continuation of land depression number x for June, 1886, and passed northeastward over Newfoundland during the 1st, with central pressure about 29.50 (749.3); moving southeastward, off the northern coast of Newfoundland, it was central on the 2d in N. 47°, W. 50°, whence it passed northeastward to N. 50°, W. 45° by the 3d; during this date it advanced northeastward beyond the region of observation. No special reports have been received relative to this storm for the first three days of July, although vessel reports show that severe gales were experienced south of Newfoundland during June 30th.

2.—This depression first appeared on the 1st in N. 42°, W. 44°, and moved rapidly northeastward during the next two days, disappearing north of the fifty-fifth parallel during the 3d. This storm had pressure about 29.80 (756.9) on the 1st and 2d, after which it apparently commenced to fill up.

The following are reports of vessels which came within its influence: By Chief Officer Wm. Kinning, of the s. s. "Roman," Capt. D. Williams, commanding, "July 2d, in N. 45° 17', W. 41° 38', a fresh gale began from sw. at noon; veered to nw., then backed to w. and increased to strong gale w. at midnight, with very heavy seas, and continued backing to sw. in a. m. of July 3d, in N. 43° 38', W. 45° 21'; then veered to w. in p. m., and moderated at 8 p. m. July 2d, at noon, barometer 29.79 (756.7), and at noon on the 3d it read 29.84 (757.9)." By Chief Officer J. Barlow, of the s. s. "Bothnia," Capt. Thos. Dutton, commanding, "July 3d, in N. 48° 19', W. 32° 36', at 8 a. m., strong breeze from sw., and cloudy with heavy head seas, continuing all day; ship pitching and shipping seas forward; showers at midnight. July 4th, in N. 46° 34', W. 38° 30', strong breeze from w. to sw., with head seas; ship pitching and shipping considerable water forward;

wind veered to nw. and moderated at noon. Lowest barometer, 30.04 (763.0), from midnight of the 3d to 1 a. m. of the 4th.

Capt. B. F. Rehm, commanding the bark "Victoria," submits the following: "July 2d, in N. 46° 17', W. 35° 32', at noon; at 5.30 p. m. threatening clouds commenced working up in the nw. quarter, with a steady and strong breeze from the ssw. to south; at 8.50 p. m. a sudden furious whirlwind set in from south through west to nnw., with rain; the whirl lasted about seven minutes, when the wind again prevailed steady, and fresh gale from sw., with occasional showers of rain until the morning of the 3d; after which strong breeze from sw. to ssw. continued, with hazy and fair weather."

3.—This depression passed northeastward over the southeastern portion of Newfoundland during the morning of the 8th, and was central at noon (Greenwich mean time) of that date in about N. 49°, W. 52°, with pressure ranging below 29.60 (751.8); continuing a northeasterly course it is traced to N. 54°, W. 41° on the 9th, during which date it dominated the weather conditions north of the fortieth parallel and west of the twentieth meridian. During the next two days the depression moved rapidly north of east, and, passing north of Scotland, disappeared in the direction of the Norwegian coast during the 11th.

The following special reports relative to this storm are at hand:

Capt. F. Paton, commanding the s. s. "Persian Monarch," "July 8th, in N. 41° 49', W. 54° 52', at noon; at 10 p. m. heavy thunder and lightning and rain, with heavy wsw. gusts, at intervals, till 4 a. m. of the 9th, when weather began to clear." Chief Officer W. Wallace, of the s. s. "Austrian," Captain Amberg, commanding, "July 11th, in N. 54° 17', W. 21° 19', at 1 p. m. fresh gale began from wnw., with heavy head sea; shipped water over the bow. Fresh gale continued on July 12th, in N. 53° 14', W. 25° 51', from wnw., with high seas and squalls until 10 a. m.; then moderated and backed to w. in p. m.; lowest barometer, 29.87 (758.7), from 1 a. m. to noon on the 11th." Chief Officer Denchars, of the s. s. "Annandale," Captain Leisk, commanding, "July 11th, in N. 60° 25', W. 19° 20' (at noon), strong gale began in a. m. from wsw., veered to wnw. at 7 p. m., and continued with heavy seas throughout the 12th, in N. 59° 19', W. 22° 40' (at noon), until the morning of the 13th, in N. 57° 48', W. 26° 23', then moderated; lowest barometer at 4 p. m. of the 11th."

The s. s. "Martells," Capt. F. E. Jenkins, commanding, passed about ten degrees to the southward of the storm's track, and the following report of Chief Officer Bennington gives the unsettled conditions which existed following its passage: "July 11, in N. 47° 49', W. 28° 15' (at noon), a moderate gale began from the west, at night, increasing to fresh gale w. in a. m. of 13th, in N. 46° 8', W. 33° 36', with increasing sea; 8 a. m., wind veered to nw. and moderated at noon. Barometer at noon of the 12th, 30.09 (764.3), and on 13th, at noon, 30.21 (767.3)." Chief Officer Wm. Mumford, of the s. s. "Mareca," Captain Young, commanding, "July 10th, in N. 46° 47', W. 34° 25' (at noon), had strong breeze from wsw., veering to wnw., with heavy rain and thunder and lightning in the evening, then moderated."

Although the centre of this depression passed to the northward of Scotland during the 11th, it continued to exercise a strong influence to the west and southwestward of the British Isles during the three following dates, and while it is probable that subsidiary depressions developed in its wake, reports are not sufficiently numerous to admit of their being accurately located or traced. Capt. M. Garson, of s. s. "Madrid," under date of the 13th, reports: "In N. 50° 48', W. 17° 56' (at noon), met a disturbance at 4 a. m., the rear of which apparently passed at 9 p. m.; thus it was passed through in seventeen hours, the ship having steamed during that time one hundred and sixteen miles, S. 78° W., true. The lowest barometer reading was 29.72 (754.9) at noon, with wind force 7, lasting three hours. The following shows the direction and

force of the wind at four-hour intervals, during the storm's continuance: 4 a. m., wind s., force 4; 8 a. m., wind w., force 6; 12 noon, wind w., force 7; 4 p. m., wind nnw., force 6; 8 p. m., wind nw., force 6; 9 p. m., wind nnw., force 3."

The bark "Victoria," Capt. R. F. Rehm, on the 13th, passed Lizard Head at 6.15 p. m., with a fresh breeze from the ssw. and cloudy weather; at 7.30 p. m. the wind increased to a fresh gale with thick, rainy weather; after 9 p. m. the wind increased to a whole gale from the ssw., with heavy rain; after midnight the wind gradually drew more to the sw., and at about 2 a. m. of the 14th to wsw., decreasing to moderate gale, with clearing sky from w., wnw., and fine weather. The s. s. "Stockholm City," Capt. K. Doyle, commanding, experienced a gale which was probably due to a subsidiary depression, of which the following report was made by Chief Officer Thompson: "July 14th, while off the east coast of Scotland, a fresh gale began at noon from sse., veered to nw. with high seas and continued until noon of the 15th, in N. 58° 42', W. 6° 06', then moderated."

4.—This storm was a continuation of land depression number iv, and passed north of east over the northern extremity of Newfoundland during the early morning of the 12th, and was central at noon (Greenwich mean time) of that date in about N. 53°, W. 50°, from which position it disappeared to the eastward. This depression exhibited considerable energy. On the 12th the s. s. "Mareca" entered its influence and experienced a strong breeze from the west in the a. m., with showers of rain, increasing in p. m. to moderate gale w., with high seas and thick weather at night.

5.—This storm was apparently an off-shoot of land depression number iv, and, passing eastward off the coast of Newfoundland, was central at 12 noon (Greenwich mean time) of the 13th in about N. 49°, W. 51°, with central pressure 29.80 (756.9). It then moved rapidly northeastward to N. 56°, W. 33° by the 14th, with central pressure 29.70 (754.4); following an irregular easterly course it is traced off the west coast of Scotland on the 18th, during which date it passed beyond the region of observation. No special reports have been received relative to the passage of this depression, although its track was, for the most part, in close proximity to the path of trans-Atlantic vessels. While possessing low barometric readings, it did not apparently possess unusual force.

6.—This depression first appeared on the 19th in N. 52°, W. 30°, with pressure about 29.45 (748.0), and moved south of east to N. 51°, W. 23° by the 20th, with central pressure about 29.20 (741.7); from thence passing north of east it was central on the 21st in N. 52°, W. 15°, with evidence of great energy; from which position it moved eastward and disappeared over the British Isles.

The following are reports of vessels encountering this storm:

The s. s. "Devonia," Capt. H. Young, commanding, in N. 51° 13', W. 32° 36', on the 19th, had a strong gale wsw., veering to w. and nw. by the 20th; lowest barometer, 29.22 (742.2), at 9.30 p. m. of the 19th. The s. s. "Stockholm City," on the 19th, in N. 52° 21', W. 30° 48', at 3 a. m. met a strong breeze from wsw.; 4 a. m. wind suddenly veered to nw., and increased at noon to fresh gale with heavy squalls and rain in p. m. July 20th, in N. 50° 43', W. 35° 07', at 4 a. m. a whole gale n., with squalls of hurricane force and high cross seas; the gale moderating at 4 p. m.; lowest barometer, 29.31, (744.5), at 6 p. m. of the 19th. The s. s. "Scythia," Capt. T. Roberts, commanding, in the southwest edge of the storm circle, had a strong wnw. gale on the 18th and 19th; lowest barometer, 29.90 (759.4), at 4 a. m. of the 19th, when in N. 45° 02', W. 43° 56'.

The s. s. "Umbria," Capt. W. McMickan, had a moderate gale on the 20th. The wind set in from wsw.; veered to wnw. and nw. during, and backed to sw. following, the gale; lowest barometer, 29.30 (744.2), at 4 p. m., when in N. 48° 30', W. 31° 00'. The s. s. "Iowa," Capt. S. Walters, commanding, had moderate wsw. gale on the 20th and 21st; wind veered to w. and nw.; lowest barometer, 29.14 (740.1), at 4 p. m. of 20th,

when in N. $49^{\circ} 36'$, W. $20^{\circ} 36'$. Chief Officer E. C. Laverick, of the s. s. "Hartington," Capt. W. H. Hull, commanding, submits the following: "July 21st, a moderate gale began from ssw. at midnight; increased to fresh gale at 4 a. m. of 22d, veering to wsw., with high seas and light rain, in N. $51^{\circ} 10'$, W. $8^{\circ} 07'$; wind veered to nw. and moderated in p. m."

7.—This storm was a continuation of depression number vii, which, first appearing south of Cuba on the 14th, circled northwestward into the Gulf of Mexico and eastward through northern Florida, passing into the Atlantic during the 19th. The characteristics of this depression prior to the 19th are given in this publication under the heading "Areas of low pressure." Subsequent to this date the storm moved rapidly in a generally northeast direction across the Atlantic, passing beyond the region of observation to the west of Scotland during the 24th. The depression exhibited great energy throughout its course, and was remarkable by reason of the extent of territory it traversed.

The following special reports illustrate its general character:

The bark "Balkan," in N. 33° , W. $69'$, on the 20th, had a hurricane from the sw. to nw.; lost foretopsail. The s. s. "Alpes," Capt. T. Anasagasti, commanding, on the morning of the 18th experienced a hurricane from the sse., backing to se. at 9 p. m.; to ese. at 10 p. m., and to e. at midnight; on the 19th the wind backed to ene., to ne., to n., and to nw.; lowest barometer, 29.44 (748.8), at 6 p. m. of the 18th when in N. $30^{\circ} 28'$, W. $79^{\circ} 10'$. "When the wind shifted to ne. it blew with hurricane violence for four hours, and then moderated and hauled to the northward; the storm was accompanied by lightning and heavy rain, also a tremendous sea. At 3 p. m. of the 18th the barometer read 29.64 (752.8) and fell to 29.54 (750.3) at 5 p. m., and to 29.44 (747.8) at 6 p. m. The northerly winds that followed were fresh and squally."

The s. s. "Umbria" had a strong gale on the 21st and 22d; wind set in from the sw., veered to wnw. during, and backed to sw. following, the passage of the disturbance; lowest barometer, 29.59 (751.6), at 6 a. m. of the 22d when in N. $43^{\circ} 5'$, W. $45^{\circ} 50'$. The s. s. "Gellert," Capt. W. Kühlewein, commanding, in N. $41^{\circ} 2'$, W. $55^{\circ} 1'$, on the 21st, encountered a moderate gale se.; wind backed to e., ne., n., and nw., and to sw., following the gale; lowest barometer, 29.23 (742.4), at 4 p. m. Chief Officer A. O. Welch, of the s. s. "Easington," Capt. D. Morgan, commanding, makes the following report: "July 24th, in N. $49^{\circ} 19'$, W. $15^{\circ} 18'$, a moderate gale began at night from nw., with squalls; increased to fresh gale nw. in a. m. of 25th, in N. $49^{\circ} 41'$, W. $19^{\circ} 40'$, and moderated in p. m."

Capt. C. W. Möller, commanding the s. s. "Geiser," submits the following: "July 21st, 3.32 p. m. (Greenwich mean time), ship's position N. $41^{\circ} 11'$, W. $53^{\circ} 18'$, wind south, force 7; barometer 29.75 (755.6); temperature of the air $76^{\circ}.1$ Fahr. ($24^{\circ}.5$ Cent.); barometer fell and wind increased gradually; occasional rain and overcast sky; 11.30 p. m. a gale was blowing from south, with heavy rain-gusts. On the 22d, at 1.30 a. m., the wind increased to a complete hurricane from ssw.; torrents of rain; mist and spray covered the ship, making it impossible to see the bow of the ship. Position was then N. $51^{\circ} 15'$, W. $41^{\circ} 36'$; barometer 29.33 (745.1), where it remained until 2 a. m., when the temperature of the air suddenly fell to $60^{\circ}.8$ ($16^{\circ}.0$ Cent.), and the wind hauled to sw. and w., decreasing in force; the barometer rose at the rate of .08 of an inch (2 millimetres) per hour. A very long and heavy sea lasted until the afternoon of the next day. Lost three sails and had decks overwashed with the sea. No signs of electricity during the disturbance."

8.—This storm was a continuation of land depression number viii, and, passing northeastward over Newfoundland during the early morning of the 21st, was central at noon (Greenwich mean time) of that date in about N. 50° , W. $54'$, with pressure apparently ranging below 29.60 (751.8). Passing slightly north of east it was central on the 22d in N. 52° , W. 42° , with a slight increase in pressure, and no special display of energy.

During the next twenty-four hours it moved southeastward and united with depression number 7 in N. 48° , W. 32° . No special reports have been received relative to the passage of this depression, and reports do not indicate that it was accompanied by disturbances of marked violence.

9.—This depression apparently originated in about N. 51° , W. 28° on the 22d, with pressure 29.60 (751.8) and evidence of considerable strength; from this position it moved rapidly eastward to the west coast of Ireland by the 23d, with pressure about the same as on the preceding day, and disappeared beyond the eastern limits of observation. This storm followed closely number 6, and caused a continuation of stormy weather over the British Isles and the ocean to the westward.

10.—This storm was a continuation of land depression number x, and, passing north of east over the Gulf of Saint Lawrence during the early morning of the 23d, was central at noon (Greenwich mean time) of that date off the west coast of Newfoundland in N. 50° ; from thence it moved slightly south of east to N. 49° , W. 47° by the 24th, and passed northeastward to N. 54° , W. 43° by the 25th. It then circled eastward to N. 54° , W. 36° by the 26th, and disappeared to the northeastward during that date. This depression was of slight depth, and special reports relative to its passage were not rendered.

11.—This storm was a continuation of land depression number xi, and passing north of east over Labrador during the 27th, disappeared during that date beyond the region of observation, without developing noteworthy features.

12.—Continuing land depression number xii, this storm passed northeastward over Newfoundland, and was central at noon (Greenwich mean time) of the 29th in N. 50° , W. 52° , from which position it moved north of east to N. 53° , W. 39° by the 30th, and passed east to W. 27° by the 31st, with pressure about 29.60 (751.8), and a fair display of energy. The s. s. "Easington," on the 31st, when in the extreme southwest portion of the storm's area, in N. $45^{\circ} 12'$, W. $45^{\circ} 17'$, experienced a fresh gale w. beginning at 1 a. m., with heavy head seas; calming down with dense fog in the p. m. Chief Officer Galbraith, of the s. s. "Durham City," Capt. M. P. Lund, commanding, rendered the following report: "July 29th, in N. $53^{\circ} 58'$, W. $34^{\circ} 32'$, a strong gale sse. began, with heavy rain; wind veered to wsw. in a. m. of 30th, when in N. $52^{\circ} 13'$, W. $41^{\circ} 19'$, and in p. m. veered to nw., moderating in early a. m. of 31st; lowest barometer, 29.56 (750.8), at 4 a. m. of 30th."

The s. s. "Catalonia," Capt. Alex. McKay, commanding, on the 29th, in N. $42^{\circ} 0'$, W. $55^{\circ} 50'$ (at noon), had gale ssw., force 7, from 4 a. m. until noon, with a high wsw. sea. The s. s. "Island," Capt. W. Skjodt, commanding, on the 30th and 31st had a moderate to fresh gale w.; lowest barometer 6.30 a. m. of 31st. At 2.30 p. m. of the 29th, in N. $53^{\circ} 5'$, W. $32^{\circ} 51'$ (at noon), Captain Skjodt reports having observed a large water-spout in ese., about ten miles, which continued for about two minutes, from sea to cloud, and then parted and dispersed; no effect was felt on board the ship.

Advices from Cuba state that a cyclone circled to the south and west of that island on the 6th; reports at hand are not, however, sufficiently numerous to admit of charting its track.

Rev. Benito Viñes, director of the Belin College Observatory, Havana, Cuba, has submitted the following information relative to this storm: "At 9 a. m. an anti-cyclonic breeze set in. The barometer has risen to a great height during the 2d, 3d, and 4th, and to-day and yesterday it showed indications of a cyclonic disturbance in the southwest, which, up to the present, has not appeared to be of great intensity, but it may at any time organize into greater proportions; in any case it would be advisable to telegraph information to various points, and solicit observations which may become of use."

Under date of the 7th the report continues: "The cyclonic disturbance has passed slowly to the west of us toward Yucatan, and will probably curve to the westward of Cuba. During yesterday the diameter of the storm seemed large, but the barometer showed little disturbance and rose slightly. At

sunset some cyclonic currents were noted in the upper atmosphere and the storm followed in the direction of the cirrus. After entering the open Gulf it will probably assume a larger activity."

On the evening of the 6th the storm appeared to be making direct for the island of Cuba, and the sky assumed the aspect known as the precursor of a hurricane. Rain fell at short intervals, accompanied by a strong wind, which soon abated. The cyclone, however, followed a course over the Caribbean Sea parallel with the island, and presumably inclined to the north when in the longitude of Yucatan.

OCEAN ICE.

On chart i are also exhibited the eastern and southern limits of the region within which icebergs and field ice have been observed during July, 1886. These limits have been determined from reports furnished by shipmasters, and from trustworthy data published in the "New York Maritime Register" and other newspapers.

During this month the easternmost ice was encountered on the 12th, in N. 45° 52', W. 34° 30', by the bark "Norcross," and the southernmost ice reported was observed in N. 42° 59', W. 49° 18'. Icebergs, many of them of enormous dimensions, were observed on the southern edge of the Banks, and a large number of medium to large sized bergs were encountered west of Newfoundland to the forty-fifth meridian. Many icebergs were reported during the first half of the month, in the Strait of Belle Isle, and as far eastward, in the track, as the forty-sixth parallel. In the mean distribution of icebergs for the month they were most numerous from the coast of Newfoundland to W. 46° between the forty-eighth and forty-ninth parallels.

A comparison with the chart of the preceding month (June, 1886), shows the eastern limit of the region within which ice was reported to be extended nearly three degrees, and isolated bergs were observed five degrees further east than in June; the southern limit is about two degrees further north. As compared with July, 1885, the extreme eastern limit is extended nearly ten degrees and the southern limit is about one-half degree further north.

The following table shows the comparison between July, 1886, and the same month of the three preceding years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Lon. W.	Month.	Lat. N.	Lon. W.
July, 1883.....	42 42	49 57	July, 1883.....	46 47	45 44
July, 1884.....	46 24	50 02	July, 1884.....	48 36	46 28
July, 1885.....	42 14	48 30	July, 1885.....	48 00	44 00
July, 1886.....	42 59	49 18	July, 1886.....	45 52	*34 30

* An isolated iceberg and some field ice.

The following reports were made relative to icebergs and field ice observed during July, 1886:

1st.—The s. s. "La Champagne" passed icebergs in the following positions: N. 48° 28', W. 49° 29', height, forty-five feet; N. 48° 26', W. 50° 13', height, sixty feet; N. 48° 15', W. 51° 00', height, thirty-six feet; N. 48° 03', W. 51° 25', height, thirty feet; N. 48° 00', W. 52° 25', height, ninety feet. At 10 a. m. passed Cape Race and observed three icebergs about sixty feet high. The s. s. "Grecian," in N. 52° 35', W. 52° 40', passed three large icebergs and observed others to the westward as far as Belle Isle Strait.

2d.—The s. s. "Ontario," in N. 52° 9', W. 52° 27', passed a large iceberg and several large bergs from twenty to thirty miles east of Belle Isle; passed many bergs in the Strait of Belle Isle; passed two bergs twenty-five miles west of Point Amour. The s. s. "Croma," on the 2d and 3d, in N. 49° 51', W. 48° 34', to N. 46° 18', W. 53° 35', passed numerous large icebergs, and in the vicinity of Cape Race passed a great number of bergs.

3d.—The s. s. "Clintonia," in N. 44° 20', W. 48° 00', passed a large iceberg.

4th.—The bark "Levuka," in N. 48° 50', W. 44° 05', passed a large iceberg.

5th.—The s. s. "Montreal" passed numerous icebergs sixty miles west of Point Amour; also a large number in the Strait of Belle Isle and east of Belle Isle; passed the last berg one hundred and thirty-two miles e. of Belle Isle. The bark "Nimbus," in N. 44° 50', W. 46° 40', passed a very large iceberg.

6th.—The bark "Fluorine" at 11 p. m. got clear of the ice about ninety miles off Cape Desolation.

7th.—The bark "Nimbus," in N. 44° 40', W. 49° 15', passed a large iceberg and drift ice. The s. s. "Canadian," in N. 48° 9', W. 43° 29', at 5 p. m. passed a small iceberg about thirty feet high.

8th.—The s. s. "Buenos Ayrean," in N. 52° 30', W. 51° 30', at 8.45 a. m. passed a large iceberg. From N. 52° 00', W. 53° 30' to Greenlet Island, passed a number of icebergs and small pieces of ice.

9th.—The s. s. "Circassian," in N. 52° 22', W. 53° 25', passed two very large icebergs; and in N. 52° 10', W. 54° 15', passed several icebergs; also passed two bergs in the Strait of Belle Isle, off Point Amour.

10th.—The s. s. "Wisconsin," in N. 43° 57', W. 49° 21', at 6.15 p. m. observed a large iceberg. The temperature of the water just before the ice was sighted was 52°, the air at the same time being 56°. The bark "Fluorine," in N. 51° 34', W. 49° 6', at 11.33 p. m. passed two large icebergs. The bark "Levuka," passed a large iceberg twenty-five miles north-by-west from Cape Race.

11th.—The ship "Chas. S. Whitney," in N. 48° 30', W. 46° 30', at 2 p. m. observed a large iceberg; temperature of the air, 52°. The bark "Hannah Blanchard," in N. 48° 10', W. 46° 30', passed an iceberg about one hundred and twenty feet high. The bark "Fluorine," in N. 50° 06', W. 50° 20', and N. 49° 45', W. 50° 19', passed icebergs, one in each position. The s. s. "British Crown," in N. 48° 20', W. 46° 35', passed a medium sized iceberg.

12th.—The s. s. "Wieland," in N. 43° 12', W. 48° 53', passed an iceberg, and in N. 42° 59', W. 49° 18', saw a large berg about two hundred feet high. The s. s. "Buenos Ayrean" passed a number of icebergs both outside and coming through the straits; had twelve hours delay. The bark "Norcross," in N. 45° 52', W. 34° 30', passed a small iceberg and some field ice. The s. s. "British Crown," in N. 46° 48', W. 52° 28', at 2.50 p. m. passed a medium sized iceberg, and at 7.10 p. m., in N. 46° 27', W. 53° 23', passed another berg. The bark "Fluorine," in N. 49° 15', W. 50° 00', saw an iceberg.

13th.—The s. s. "Circassian" passed thirty-eight icebergs outside of, and two in, the Strait of Belle Isle, some of monstrous size. The bark "Nova Scotia," in N. 46° 12', W. 54° 00', passed two medium sized icebergs. The s. s. "Monte Rosa," in N. 49° 50', W. 46° 20', passed an iceberg.

14th.—The s. s. "Portia," at New York, reported having seen large quantities of ice on the Newfoundland coast, large icebergs breaking up. The s. s. "Monte Rosa," in N. 47° 2', W. 51° 0', passed an iceberg; also passed several bergs near the coast between Saint John's and Cape Race, and one large berg twenty miles west-by-south of Cape Race.

15th.—The s. s. "Austrian," in N. 47° 05', W. 45° 23', at 11.30 p. m. passed a large iceberg. The s. s. "Trave," in N. 43° 49', W. 50° 08', passed an iceberg.

16th.—The s. s. "Caspian" encountered considerable fog in the vicinity of the Banks, and passed a number of icebergs, several of them grounded.

17th.—The s. s. "St. Laurent," in N. 48° 22', W. 48° 07', at 1.30 a. m. passed near an iceberg; temperature of the air 50°.8, of the water 44°.6.

18th.—The s. s. "Iran," on the southeast edge of the Banks, passed a small iceberg. The s. s. "Austrian," in N. 46°, W. 48°, passed a large iceberg two or three hundred feet high.

19th.—The s. s. "Critic," in N. 49° 48', W. 46° 10', passed a large iceberg.

23d.—The s. s. "Montreal," in N. 52° 42', W. 52° 00', passed the first iceberg; several more in sight to the westward; also saw bergs at intervals until through the Strait of Belle Isle. The s. s. "Buenos Ayrean," at 6.20 a. m., Point Amour two miles abeam, till 11.45 p. m., in N. 52° 30', W. 51° 38', passed several large icebergs.

24th.—The s. s. "Mathew Bedlington," in N. 48° 37', W. 49° 12', at 4 p. m. passed an iceberg.

25th.—The s. s. "Mathew Bedlington" at 7.45 p. m. passed an iceberg near Cape Race, bearing northeast fifteen miles.

28th.—The s. s. "La Bourgogne," in N. 43° 21', W. 53° 27', passed an iceberg.

31st.—The s. s. "Durham City," in N. 49° 48', W. 46° 20', at 6 p. m. passed two icebergs; estimated height two hundred and fifty feet; length one thousand feet. The s. s. "Jan Breydel," in N. 43° 30', W. 51° 36', at 10.30 a. m. passed two icebergs, one of moderate size, the other of enormous dimensions, being about one hundred and fifty feet above sea surface, each bearing about north to south, and two miles apart. Temperature of the air when passing 62° 5, of the water 63°.

SIGNAL SERVICE AGENCIES.

Signal Service agencies have been established in the Maritime Exchange buildings at New York City and Philadelphia, and in the Custom-House, Boston, where the necessary blanks and other information will be furnished to ship-masters.

In pursuance of the arrangements made with the Meteorological Office of London, England, there were cabled to that office from New York during July, 1886, six reports concerning storms and icebergs encountered by vessels in the Atlantic west of the forty-fifth meridian; three messages were sent from Boston.

TEMPERATURE OF THE AIR.

[Expressed in degrees, Fahrenheit.]

The distribution of mean temperature over the United States and Canada for July, 1886, is exhibited on chart ii by the dotted isothermal lines; and in the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. On chart iv the departures from the normal temperature are illustrated by lines connecting stations of normal or equal abnormal values.

The mean temperature for the month is quite abnormal, large excesses occurring in some districts and deficiencies in others. Large excesses occur in Montana, Idaho, Wyoming, and Dakota, the mean temperatures for these territories ranging from 4° to 9° above the normal. All stations in the Rocky Mountain region, the Missouri Valley, Pacific coast, and nearly all stations in that portion of the country lying west of the Mississippi River, are above the normal, southern Texas and southern California being exceptions. The mean temperature of the country east of the Mississippi River is below the normal, the largest deficiencies occurring in the southern districts, where the mean temperature for the month is about 3° colder than the average July.

The following are some of the most marked departures from the normal temperature at Signal Service stations:

Above normal.		Below normal.	
Fort Maginnis, Montana	0.0	Augusta, Georgia	0
Spokane Falls, Washington Ter.	8.8	Lynchburg, Virginia	4.1
Fort Buford, Dakota	8.7	Baltimore, Maryland	4.1
Fort Shaw, Montana	7.4	Brownsville, Texas	4.0
Deadwood, Dakota	6.7	Washington City	3.9
Fort Benton, Montana	6.6	Erie, Pennsylvania	3.8
Bismarck, Dakota	6.0	Cincinnati, Ohio	3.7
Saint Vincent, Minnesota	5.9	Chattanooga, Tennessee	3.6

RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily, ranges of

temperature, are given in the table of miscellaneous meteorological data.

The following are some of the greatest and least monthly ranges at Signal Service stations:

Greatest.		Least.	
Poplar River, Montana	63.8	Cape Hatteras, North Carolina	17.8
Boise City, Idaho	62.6	Cedar Keys, Florida	19.6
Fort Shaw, Montana	62.4	Smithville, North Carolina	21.6
Fort Benton, Montana	61.7	Pike's Peak, Colorado	22.1
Fort Assinaboine, Montana	61.5	New Orleans, Louisiana	22.1
Winnemucca, Nevada	60.8	Pensacola, Florida	22.3
Helena, Montana	60.0	Indianola, Texas	22.5
Fort Custer, Montana	58.6	Brownsville, Texas	22.8

Table of comparative maximum and minimum temperatures for July.

State or Territory.	Station.	For 1886.		Since establishment of station.			
		Max.	Min.	Max.	Year.	Min.	Year.
Alabama	Mobile	92.7	64.8	101.0	1883	63.8	1882
Do	Montgomery	95.0	65.3	106.9	1881	60.8	1882
Arizona	Prescott	96.1	50.9	103.0	1878	41.0	1879
Do	Fort Apache	100.2	54.3	102.5	1881	42.0	1879
Arkansas	Fort Smith	102.6	62.2	104.5	1884	61.0	1882
Do	Little Rock	93.8	66.0	101.3	1884	61.0	1882
California	San Francisco	77.8	49.7	83.0	1881, 1884	49.0	1874, 1881
Do	San Diego	81.2	57.0	86.0	1877	53.7	1884
Colorado	Denver	96.3	55.5	102.3	1874	42.0	1873
Do	Pike's Peak	57.1	35.0	64.0	1879	18.0	1876
Connecticut	New Haven	90.3	51.2	95.0	1876	50.3	1885
Do	New London	88.0	54.3	93.0	1876, 1878	51.0	1879
Dakota	Fort Buford	105.9	49.7	104.0	1881	37.5	1884
Do	Yankton	102.7	56.2	103.0	1883	44.0	1877
Delaware	Del. Breakwater			91.0	1880	59.0	1882
Do	Washington City	91.2	60.2	102.0	1879	54.1	1885
Florida	Jacksonville	93.7	70.2	104.0	1879	68.0	1877, 1879
Do	Key West	99.5	72.0	97.0	1880	72.7	1883
Georgia	Atlanta	92.8	57.8	97.5	1881	57.8	1882
Do	Savannah	92.0	69.0	105.0	1879	65.4	1879
Idaho	Boise City	105.9	44.3	106.0	1877	41.0	1880
Do	Lewiston			104.8	1882	48.0	'80, '81, '82
Illinois	Cairo	92.9	62.0	99.0	1874, 1881	60.0	1883
Do	Chicago	94.5	55.1	99.0	1874	50.0	1873
Indiana	Indianapolis	94.8	50.9	101.0	1881	47.5	1885
Indian Territory	Fort Sill	105.0	67.0	105.0	1881	56.0	1880
Iowa	Dubuque	100.4	53.1	101.0	1874	50.4	1882
Do	Keokuk	97.5	58.0	100.0	1874	56.0	'73, '80, '83
Kansas	Dodge City	100.2	62.0	108.0	1876	50.0	1877
Do	Leavenworth	100.2	59.5	104.0	1874	53.5	1882
Kentucky	Louisville	96.7	58.3	102.0	1874	54.0	1885
Louisiana	New Orleans	92.9	70.8	96.0	1877	69.8	1882
Do	Shreveport	100.4	65.9	107.0	1875	64.0	'77, '80, '82
Maine	Eastport	87.4	48.1	86.0	1873, 1880	45.0	1882, 1874
Do	Portland	94.2	48.5	97.0	1876	51.0	1876, 1882
Maryland	Baltimore	92.2	58.9	99.0	'76, '79, '80	56.0	1885
Massachusetts	Boston	95.4	54.5	101.0	1880	46.0	1874
Michigan	Detroit	92.0	53.3	100.0	1878	50.0	1873, 1883
Do	Alpena	98.2	43.0	97.0	1876	44.1	1881
Minnesota	Duluth	94.0	46.2	99.0	1883	46.0	1875
Do	Saint Paul	94.0	54.7	100.0	1883	46.0	1873
Mississippi	Vicksburg	96.1	65.8	100.0	1878, 1881	62.0	1881
Missouri	Saint Louis	96.1	62.7	104.0	1881	57.0	1876
Montana	Fort Benton	110.8	49.1	107.0	1881	37.0	1874
Do	Helena	103.1	43.1	98.0	1880	38.0	1880
Nebraska	North Platte	102.4	56.3	107.0	1877	45.0	1877, 1882
Do	Omaha	100.0	59.2	115.0	1874	51.0	1877
Nevada	Winnemucca	100.2	39.4	104.0	1877	37.0	1877, 1878
New Hampshire	Mount Washington	47.0	28.5	72.0	1881	27.0	1883
New Jersey	Atlantic City	86.1	58.3	99.0	1880	53.0	1880
Do	Sandy Hook	93.0	61.4	100.0	1876	50.0	1880
New Mexico	Santa Fe	93.0	55.0	95.5	1878	46.0	1872, 1880
New York	Buffalo	86.7	51.3	90.0	1878	47.5	1876
Do	New York City	90.5	60.0	99.0	1876	56.2	1885
North Carolina	Charlotte	93.7	59.9	101.0	1879	56.1	1885
Do	Wilmington	94.5	66.0	103.0	1879	62.0	1881
Ohio	Cincinnati	94.7	60.0	103.5	1881	53.0	1885
Do	Cleveland	92.0	51.1	96.0	1878	49.6	1883
Oregon	Portland	93.9	50.4	99.0	1885	40.0	1875, 1880
Do	Roseburg	100.0	44.5	100.8	1885	40.0	1879
Pennsylvania	Pittsburg	95.8	53.5	102.7	1881	50.0	1885
Do	Philadelphia	93.8	59.3	100.0	1876	56.0	1883
Rhode Island	Block Island	80.3	57.7	87.8	1885	55.0	1883
South Carolina	Charleston	92.1	64.7	104.0	1879	66.0	1885
Tennessee	Knoxville	94.4	57.2	100.0	1879	52.2	1885
Do	Nashville	96.0	56.7	101.2	1881	56.3	1882
Texas	Fort Davis	101.7	55.3	110.0	1881	53.0	1881
Do	Galveston	92.5	67.9	97.0	1875	69.0	1880
Utah	Salt Lake City	98.6	51.4	99.7	1885	45.0	1880
Virginia	Lynchburg	94.6	60.6	101.8	1881	54.4	1885
Do	Norfolk	92.2	64.0	102.5	1876	59.4	1885
Washington Ter.	Olympia	86.8	45.1	97.0	1885	40.0	1882
Wisconsin	La Crosse	95.5	56.7	101.0	1874	52.0	1880, 1883
Do	Milwaukee	97.5	49.7	95.0	'71, '74, '78	50.0	1875, 1876, 1880, 1883
Wyoming	Cheyenne	96.2	46.4	100.5	1881	37.6	1882

DEVIATIONS FROM NORMAL TEMPERATURES.

In the table below are given, for certain stations, as reported by voluntary observers, the normal temperatures for